Section 3:
Planning A Development Which Is Compatible With Public Transportation

I. LAND USE FACTORS AFFECTING TRANSIT USE

A number of factors determine whether a public transportation market exists and whether it will be easy for the tenants of a particular development to use public transportation. A "compatible" development should reflect most of the following characteristics:[1]

A. It should be located within the existing developed area.

B. It should represent a medium to high intensity use of the site.

C. It should be near a transit center or an existing or planned transit route whose service levels are adequate to attract peak period commuters (generally, 30 minute headways, minimum).

D. If possible, it should have the ability to generate off-peak (midday and evening) ridership.

E. It should have the potential to generate transit trips. Transit supportive uses include medium to high density residential uses, office buildings, and high intensity commercial activity.

F. The site plan should orient the development to the street, rather than separate the building from the street by parking. Direct building entrances and walkways to the street and transit should be provided.

G. Parking supply should be minimized within local requirements.

Each of these factors will be reviewed individually in the following pages. This section also culminates with a Public Transportation Compatibility Worksheet (Figure 8).

A. Density

Transit service and density are closely interrelated, both at the point of origin and at the destination end of trips. Metro supports increased population densities along existing transit corridors. Local jurisdictions should use proximity to existing public transit as one criterion when zoning increase changes are requested. Developers requesting a rezoning of property to a high density development would receive a more favorable response if that property is located on an existing transit line, within 800 feet of a bus stop.

1. Residential Density

Transit service areas with residential density in the range of 2400-3700 persons/sq. mile have displayed consistently higher per capita ridership than areas with about 1850 persons/sq. mile.[2]

Higher density communities also provide the ridership density and shorter trip lengths that mean improved cost recovery, leading, in turn, to increased levels of service.

Net residential density (density of the residential acreage, excludes land that is vacant or zoned for other purposes) can be related to a desirable threshold of concentration, which can support cost-effective and relatively frequent local transit service. A threshold of seven dwellings per residential acre can be used as an indicator of the minimum residential density supporting local transit service, based on:[3]

- A minimum threshold density of seven dwelling units per acre suggested by Pushkarev and Zupan (based on experience in the New York region).

- An average residential density of seven to eight dwelling units per acre specified as a desirable density by King County's adopted Comprehensive Plan.

- A standard for residential density along collector streets of eight to 12 dwelling units per acre in King County's Comprehensive Plan.

Residential densities of at least seven dwelling units per acre are considered necessary to economically justify use of local bus routes operating with 30 minute service.[4] As residential density rises to 30 dwelling units per acre, transit usage has been found to triple. At 50 dwelling units per acre, transit trips made by residents of a particular development become more numerous than auto trips.[5]

A local example of transit use resulting from high population densities is Metro's #10 bus route, which circulates between Capitol Hill and the Seattle CBD. For the purpose of this example, one dwelling unit is considered to represent one household. Route 10 traverses more than seven census tracts, which have residential densities averaging 13.3 households per acre. With 10-15 minute headways even during midday hours, Route 10 achieves a relatively high productivity of 101 passengers per revenue hour.* This is measured as average passengers per revenue hour, based on all-day counts in both directions. Route 10's high productivity compares with the average system productivity of 26 passengers per revenue hour. Route #10 ranks second highest of all routes serving areas entirely within the Seattle city limits. It should be noted that for high transit mode splits to occur, pockets of high residential density need to be located reasonably close to and geographically aligned with areas of high employment density.

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*Revenue hour is an aggregation of time during which service is available to carry passengers; it excludes layover, deadhead or other "non-revenue" service time.

2. Employment Density

An employment density of 50 employees per employment acre has been suggested as an indicator of significant transit use. This figure is based on a study performed for Metro which compared 1975 employment and population data from PSCOG with 1977 Metro origin-destination survey data for important activity centers.[6] As the number of employees per acre increased from 25 to 60, the transit mode split increased from 1 percent to a range of 6 percent to 11 percent. The study concludes that transit ridership increases significantly when employment density exceeds approximately 50 employees per acre for employment or activity centers with more than 10,000 jobs. It should be emphasized that the site threshold is an important factor in determining whether there will be a "pay-off" for increasing density (see discussion on "Forecasting Transit Demand" in section 2, I.A.2.)

Table 5 shows net employment densities for selected major activity centers in King County.

TABLE 5

EMPLOYMENT DENSITY FORECASTS FOR SELECTED MAJOR ACTIVITY CENTERS

FAZ #	FAZ Designation	Employment in 2000	Jobs/Employment Acre in 2000
6010	Seattle CBD (including Regrade)	137,000	710
6212	University Distr.	42,000	65
4900	Bellevue CBD	33,000	302
6221	Northgate	21,000	49
5410	Overlake/Redmond	19,000	18
5200	Bel/Red	15,000	33
5810	Duwamish	24,000	41
3600	Kent Industrial	31,000	15
3020	Central Federal Way	11,000	14

Source: PSCOG, Population and Employment Forecasts, March 1984.

B. Location of Development

Although transit access is often considered to be a low-priority factor in the location decision of most developers, it will become increasingly important as traffic congestion increases and conditions to mitigate traffic are levied on new developments, or if energy costs increase.

When a new development is located within an existing activity center, the cost of providing public facilities and service to that development will be lower than if it is located in an undeveloped area. For this reason, King County encourages most commercial and industrial development to locate in existing urban activity centers, where public facilities and services are already in place or needed improvements can be provided cost-effectively.[7]

Clustering of activities also results in a concentration of trip ends. When a recreation complex, health unit, public library and senior citizens' center, for example, are all situated adjacent to a shopping mall, the transit routes that serve the shopping mall also allow people to travel to the other activity centers without transferring.

The King County Comprehensive Plan defines "Urban Activity Centers" as major concentrations of commercial and industrial development.[8] The plan encourages high-density housing in such centers, including multifamily housing and mixed-used development. With housing and commercial uses in the same structure or on the same site, employees are able to combine work and shopping trips.

The Urban Activity Centers envisioned in the King County Comprehensive Plan vary in size.[9] Some are intended to be major concentrations of employment and trade, such as downtown Bellevue and Federal Way. Others may be relatively small, for example, 80 to 100 acres -- with office and manufacturing square footage not much greater than the retail square footage. Urban activity centers are planned to be approximately three to six miles apart, allowing for short work and shopping trips while providing for distinct and separate centers.[10]

Metro's long range planning also focuses on major activity centers. Peak-hour service is concentrated in a number of "secondary urban areas" -- the University District, First Hill, the Bellevue CBD, and the Duwamish Industrial Area -- in addition to the Seattle CBD. The plan calls for midday coverage to focus on a system of transit centers to be located in suburban activity centers. These activity centers include Bellevue, Northgate, Aurora Village, Kirkland, Overlake, Eastgate, Issaquah, Tukwila, Auburn, Burien, and Federal Way. Transit centers are generally facilities where buses on a number of different routes will be scheduled to arrive within a five minute period, allowing passengers to transfer between the routes with a minimum wait. Since off-peak headways are normally much less frequent (30-60 minutes) than peak-hour headways, and direct point-to-point service between activity centers is often unavailable without a transfer, transit centers are an efficient way to make the most of existing service.

Developments located within an existing activity center will be able to offer tenants increased access to regional travel opportunities.

C. Proximity to Existing Transit Service

The decision of where to locate a new development should include some consideration of proximity to existing transit service. Some points that should be kept in mind by the developer are:

Distance

- People can be expected to walk no more than 500-1000 ft. to a bus stop.[11] This distance should not be measured in a straight line to the bus stop, but should be the actual distance walked, given circuitous roadway patterns and a lack of walkways in subdivisions.

- Age, income level, and auto availability appear to have a marked impact on median walking distance.[12] People older than 45 are willing to walk slightly less far than younger people. At distances of about 750 feet or more, access on foot by seniors declines rapidly. Steep grades greatly

reduce walking speeds and particularly deter seniors from walking anything but a fraction of average distances.

- Occasional users who ride the bus no more than once a week are inclined to walk less to reach a bus stop, particularly in high income areas.[13]

Stability

- Transit routes on major arterial streets are less likely to change.

Access

- If a residential development is not going to be located within walking distance of a transit route, it should at least be within easy driving distance of a park-and-ride lot. The principal draw area for a park-and-ride lot extends from one mile beyond the lot (toward the principal destination) to six to ten miles outbound.

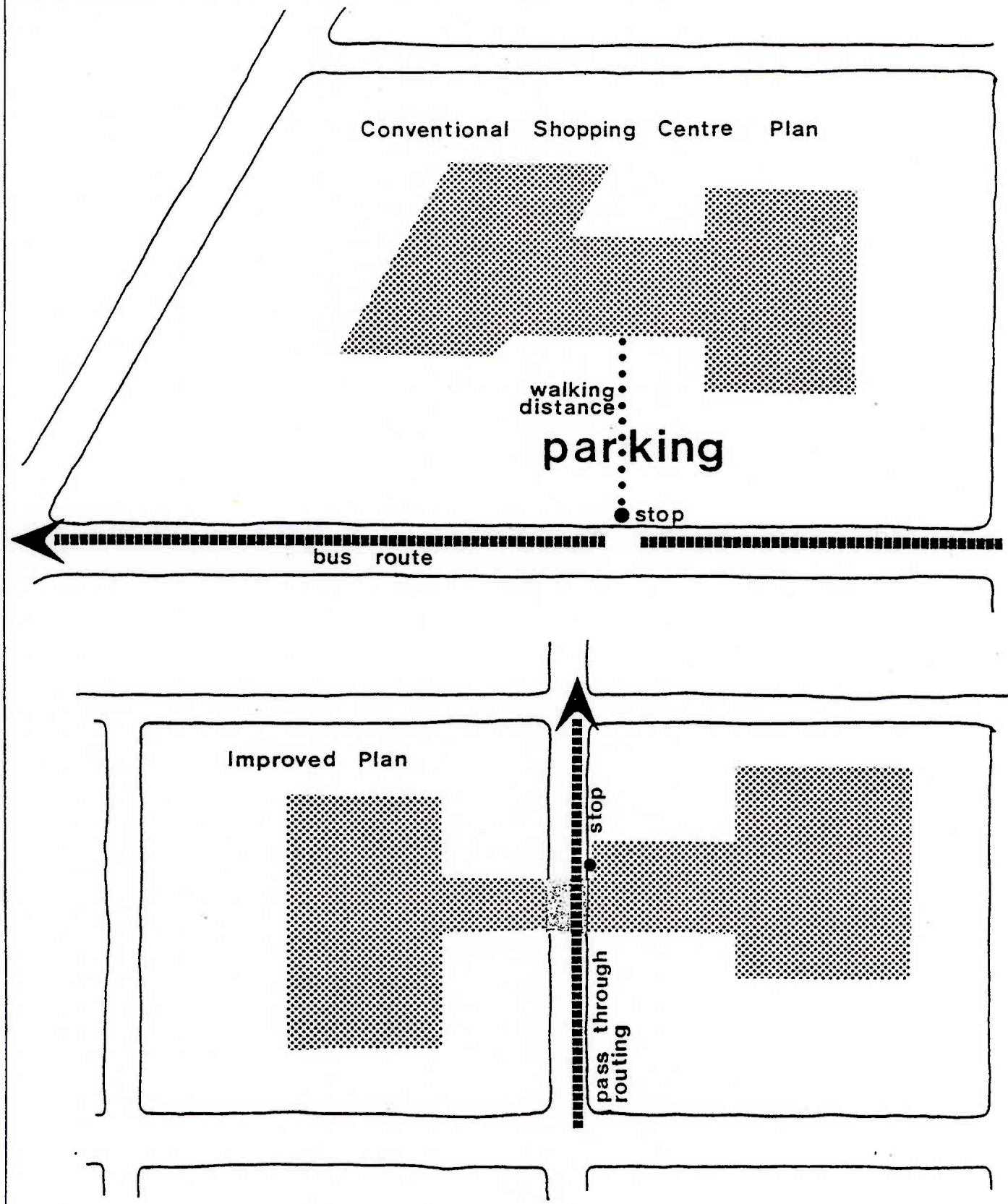
Shuttle Service

- The developer might consider providing shuttle service for tenants to a nearby transit center or Park-and-Ride lot.

Site Design

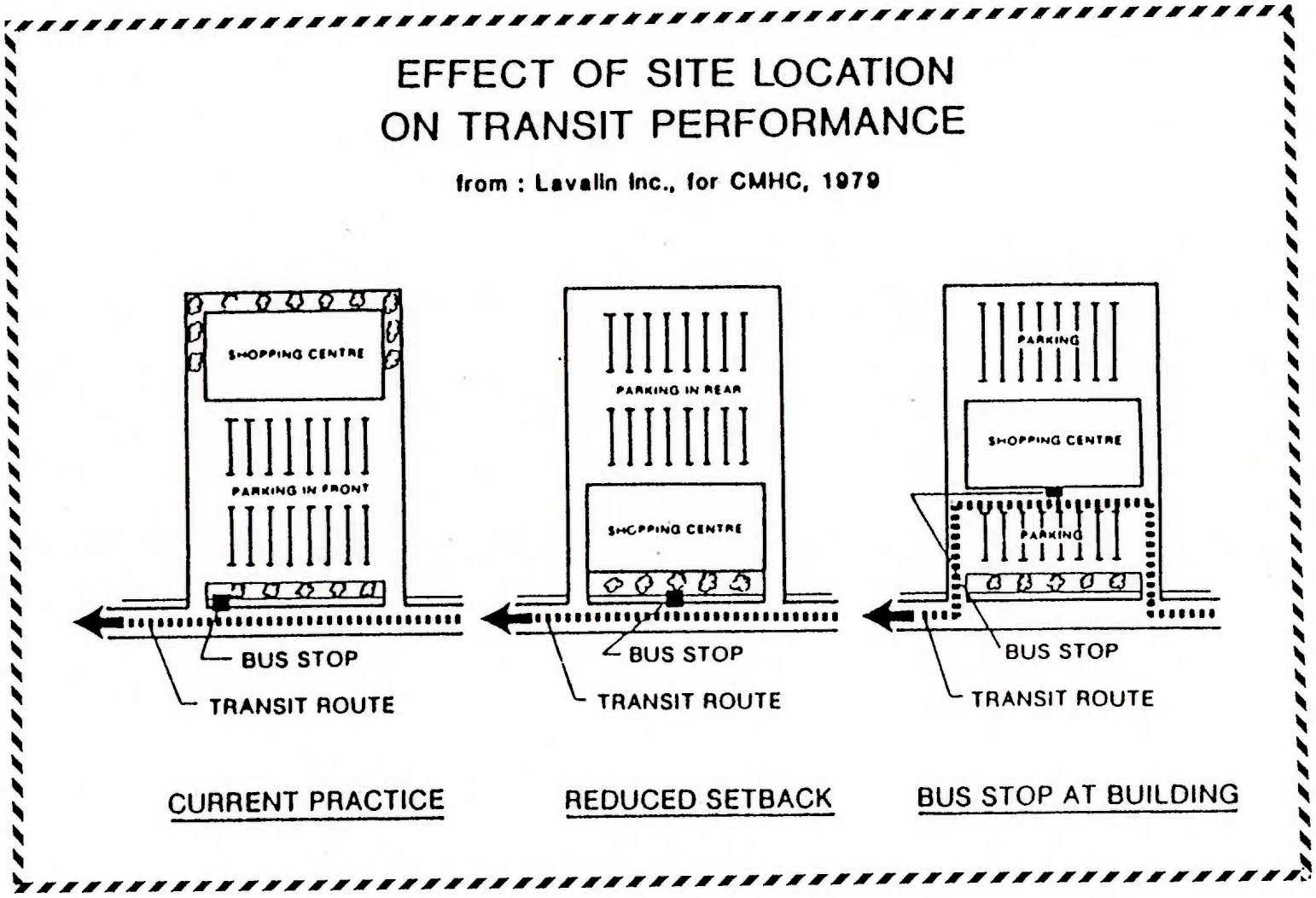
- Providing bus turnouts, adequate curb radii, concrete pads for shelters, and roadways designed for transit vehicle access can help make a case for an employment complex, residential development, or shopping center to obtain on-site transit service. Standards for accommodating transit and ridesharing vehicles can be found in Metro's Transportation Facility Design Guidelines, April 1985.

- Parking should be put in back instead of in front of the development to decrease walk distances for transit users. (See Figures 4 and 5.)



Source: L. E. Miller, Community Planning for Public Transit, Transit Services Division, Ministry of Municipal Affairs and Housing, Province of British Columbia, 1976.

FIGURE 4
Shopping Center Design



Source: Guidelines for Public Transit in Small Communities, Small Community Systems Branch, Urban Transit Authority of British Columbia, 1980.

FIGURE 5
Effect of Site Location on Transit Performance

Several studies indicate that proximity to timed transfer operations or transit centers can stimulate retail business at shopping centers and increase accessibility to employment sites. A survey of merchants at Aurora Village Mall in north King County in December 1985 showed that 79 percent of the retailers believed the Aurora Village Transit Center to be a positive benefit for the mall; 19 percent of the merchants were able to tie increases in sales to the existence of the transit center. Other communities where beneficial impacts have occurred include:[14]

- Vancouver, B.C. - Store managers at Lougheed Mall reported a "definite sales increase" after a transit center was implemented in their parking lot.

- Edmonton, Alberta and Portland, Oregon - Managers of the major shopping centers where timed transfers are operating noted increases in the number of customers using transit.

- Orange County, California - A study conducted in 1982 for Orange County Transit District by JHK & Associates at ten shopping centers served by the transit system indicated that between 19 percent and 65 percent of all shoppers and shopping center employees who came by transit would not have made the trip to the center if the bus had not been available. Of these, between 37 percent and 100 percent said they would have gone to another shopping center instead.[15]

Even businesses in the vicinity of passenger shelters can benefit when transit riders stop in to buy food or run an errand while waiting to catch the bus. A Metro survey conducted at five major bus stops in downtown Renton, Washington in June 1985 indicated that 70 percent of the 445 passengers responding patronized nearby businesses while waiting to transfer or catch a bus. Types of businesses patronized included retail stores (41 percent), restaurants (32 percent), banks (14 percent), professional offices (7 percent), and other businesses (6 percent).

D. Mixed Use Development

The number of persons who live in an activity center and work elsewhere will decline as the size and diversity of the center increases. Balancing residential development (trip productions) with commercial/industrial development (trip attractions) in reasonably close proximity, assists transit systems by:

1. Shortening trip lengths and allowing transit to concentrate more service on shorter line segments, and

2. Creating more reverse direction trips which will afford better use of transit and highway resources in the "off-peak" direction.[16]

A mixed use development is one which contains a variety of uses in one project. By combining office, residential, and retail uses, the need to travel can be reduced because many tenants do not have to go elsewhere to shop or work. Such developments work best if regional shopping, cultural, and entertainment activities, as well as high-density residential uses, are clustered in activity centers convenient to the transportation system.

King County allows residential densities of 48 units per acre for mixed use developments in urban activity centers.[17] Even higher residential densities are permitted in areas with frequent transit service. Similarly, developers of office buildings are encouraged to develop at high employment densities and locate near retail stores and services.

Higher densities and reduced parking requirements are offered as incentives for mixed use developments that provide additional amenities such as enclosed parking, usable public space and major landscaping, and convenient transit access.

Mixed use developments are beneficial to local jurisdictions because they can:

1. Generate business in retail areas.
2. Provide opportunities for shared parking.

3. Reduce the use of automobiles for lunch hour and after-work shopping trips.
4. Support more frequent transit service.
5. Make activity centers lively places in evenings and on weekends.

E. Design Form

Even if a development is located close to bus service, tenants of a project may not be motivated to use transit if the building orientation does not provide convenient transit access. There are a number of simple design features that can improve transit compatibility. These include:

Location of Parking

- Buildings should be directed toward bus stops and pedestrian approaches rather than toward parking lots. Shopping centers, for example, very seldom provide any attractive way for a pedestrian to reach the "front door" from the street without a lengthy walk through what is invariably an automobile-oriented zone. Transit operators are hesitant to enter parking lots where the bus can be tied up in long traffic queues.

  Site planning guidelines that favor large setbacks from street frontages either for parking or landscaping purposes, place the transit patron at a disadvantage in terms of the distance between the bus stop and main entrance. Parking lots and large landscaped areas should be situated at the sides or rear of the building, as shown in Figure 5.

Pedestrian Amenities

- Foot travel can be stimulated by connecting complexes with attractive, landscaped walkways and pedestrian arcades.

- Paved all-season walkways and adequate lighting should be provided between the building and nearest transit stop.

On-Site Provisions for Transit

- Provisions should be made for on-site bus turn-outs, passenger shelters, and large vehicle turnarounds.

- Paved passenger standing areas should be provided at all potential bus stop locations.

- Public transit routings through the center of the development should be encouraged so that as many people as possible are within short walking distance of stops. (See illustrations in Figures 6 and 7.) Bus service should penetrate major office parks rather than skirt their perimeters and provide front entrance drop-offs and boardings. A recent study indicated that a transit service utilizing a direct central routing could operate at better than one-third the cost of a peripheral routing given the same service levels and population density.[18]

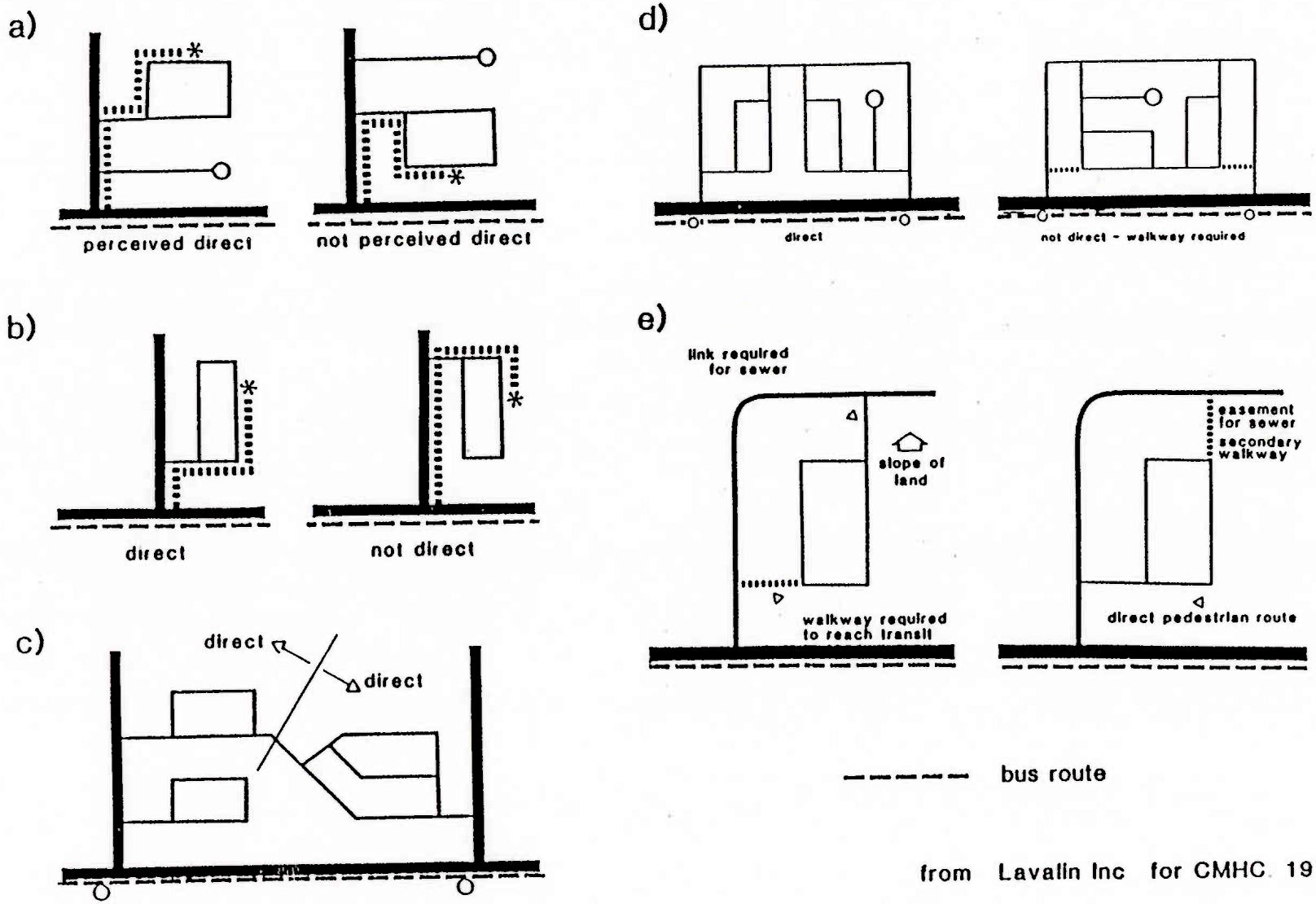
F. Street Layout

The incorporation of transit route planning early in the subdivision design process will, in most cases, ensure that walking distances to transit are kept to acceptable levels. Community planning and road system design should also provide for the incremental extension of transit routes without the need to restructure or substantially revise existing service.

The following guidelines may assist local jurisdiction staff in planning a street network which can be efficiently served by public transit:

- Design arterials and transit service in advance of development, to connect clusters.

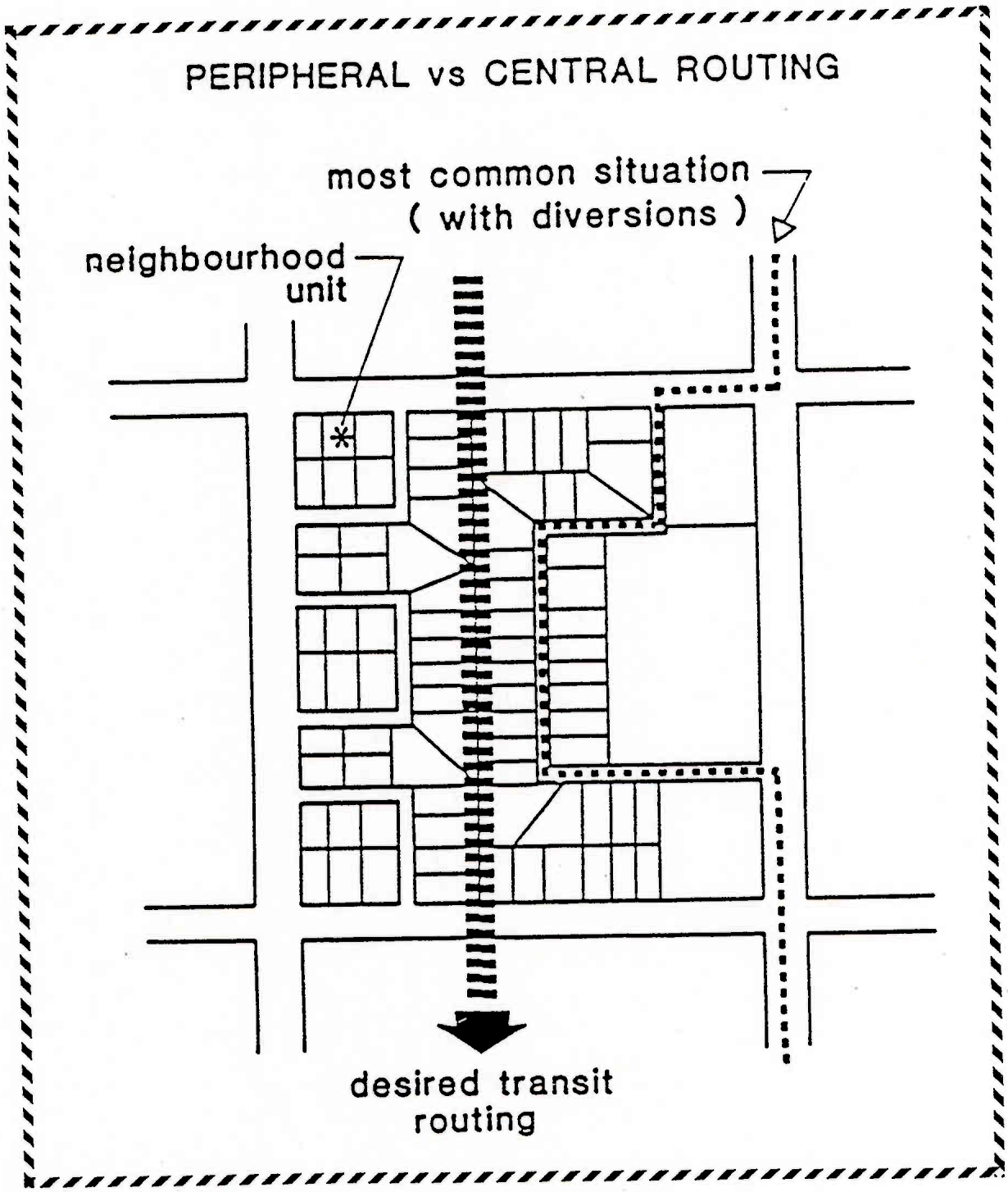
- Encourage neighborhood and service area designs that minimize street lengths and the percentage of area devoted to streets.



Source: Guidelines for Public Transit in Small Communities, Small Community Systems Branch, Urban Transit Authority of British Columbia, 1980.

FIGURE 6

Variations on Current Design Practice to Promote Direct Access to Transit



Source: Guidelines for Public Transit in Small Communities, Small Community Systems Branch, Urban Transit Authority of British Columbia, 1980.

FIGURE 7
Peripheral versus Central Routing

- Apply suitable roadway geometrics to accommodate bus turning maneuvers. (Refer to Metro Transportation Facility Design Guidelines, April 1985.)

- Ensure that streets identified for possible transit usage be structurally capable of supporting the weight of transit vehicles.

- Curvilinear and discontinuous streets (cul-de-sacs) typical of suburban residential areas may restrict the routing of buses and make it difficult for transit to provide service within easy walking distance of most residents. A simple connection of the central collector street through the entire neighborhood would permit direct transit services to operate within a few hundred feet of all residents.

  A grid system with a regular hierarchy of local, collector, and arterial streets, or a pie-shaped configuration with arterials and collector streets radiating out from the center of the city provide easy access to property. Radial street networks which focus on a group of passenger destinations such as a shopping/recreation center give this center more direct accessibility potential than a grid network does.

- Sidewalks should be provided on at least one side of the street carrying transit. Sidewalks and an attractive pedestrian environment are particularly necessary on collector and arterial roads.

- Bicycle access to transit centers, park-and-ride lots, freeway flyer stops, and other major bus stops should be encouraged by local jurisdictions. Wide curb lanes (13 feet minimum) or striped bike lanes should be considered for major streets leading to transit facilities.

- Minimize overall walking distances by:

  appropriate location of the collector roadway system to be used by transit

- placing all high-density developments on the streets serviced by transit and placing all medium density developments on streets carrying transit, or in closer proximity to such streets than low-density development.

FIGURE 8
PUBLIC TRANSPORTATION COMPATIBILITY WORKSHEETS

Authoritative evaluations of the public transportation compatibility/incompatibility of proposed developments can only be made on a case by case basis. The worksheet should be interpreted flexibly, recognizing that design detail in individual circumstances are the determinate of what can or cannot be made compatible with public transportation. For broader application you may wish to develop separate worksheets which acknowledge the unique attributes of specific types of land uses.

		Yes	No
A.	**Relationship to Transit**		
1.	Is the site within a quarter mile of a Metro route in an urban area, or within a half mile of a Metro line in a suburban area?	_____	_____
2.	Can an existing Metro line sufficiently serve the transportation needs of the development?	_____	_____
3.	Will the proposed development take advantage of nearby public transportation?	_____	_____
4.	Would potential users want to use transit to go there?	_____	_____
B.	**Orientation to Automobiles**		
1.	Is the development feasible without relying primarily on automobile access?	_____	_____
2.	Would the proposed development function in a manner that could be characterized as other than a primarily automobile oriented use? (Would parking requirements be compatible with transit/ridesharing?)	_____	_____
3.	Are the number of parking spaces provided greater than that required by the local jurisdiction?	_____	_____
4.	Are carpools and vanpools given priority parking spaces closest to the building entrance?	_____	_____
5.	If there is a charge for parking, is there a discount for HOVs (high occupancy vehicles)?	_____	_____
C.	**The Site Plan**		
1.	Does the site plan orient the development to the street?	_____	_____
2.	Does the site plan treat parking in a manner as to not separate the development from the street by parking?	_____	_____
3.	Does the site plan provide direct building entrances to the street and to transit?	_____	_____

		Yes	No
4.	Are there passenger loading zones where carpools and vanpools can pick up riders?	_____	_____
5.	Does the site plan provide weatherization improvements for pedestrians?	_____	_____
6.	Does the site plan provide for direct quality pedestrian access to transit?	_____	_____
7.	Does the site plan allow for pedestrian and transit amenities such as street trees and passenger shelters?	_____	_____

D. **Trip Generation**

1.	How many automobile trips will the proposed use generate both in the peak and off-peak hours?	_____	_____
2.	Is the developer proposing any incentive programs to reduce SOV (single occupant vehicle) trips generated by the development?	_____	_____
3.	What is the potential of the proposed development to generate transit/ridesharing trips in both peak and off-peak?	High Medium Low	_____ _____ _____
4.	What is the proposed development's potential to generate pedestrian trips?	High Medium Low	_____ _____ _____

E. **Intensity of Use**

		Pop. Density	Emp. Density
1.	What is the proposed population/employment density of the proposal?	_____	_____
2.	Does the proposed development represent a high, medium, or low intensity use of the site?*	High Medium Low	_____ _____ _____

*Based on findings by Pushkarev and Zupan, the following figures may be used as thresholds for residential intensity: high = 15+ dwelling units/acre
medium = 7-14 dwelling units/acre
low = less than 7 dwelling units/acre

Source: Tri-Met, Planning with Transit -- Land Use and Transportation Planning Coordination, May 1979, page 34.

REFERENCES

Section 3: Planning a Development Which Is Compatible with Transit

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18 Op Cit., Guidelines for Public Transit in Small Communities, p.25.

Section 4:
Parking Management

I. OVERVIEW

A. Definition and Goals of Parking Management

Parking management can be defined as actions taken to alter the supply, operation, and/or parking demand of a jurisdiction's parking system and to further the attainment of local transportation, economic, environmental, and other objectives.[1]

Policies governing the supply and price of parking are increasingly undergoing revision in cities seeking to revitalize their economy and reshape development. To many planners, engineers, elected officials, and others, parking management appears to be viewed primarily as a system of disincentives intended to:

- Discourage automobile travel, particularly travel by single-occupant automobiles.
- Control or reduce the supply of parking.
- Increase parking rates.

This "restrictive" perception of parking management is only one aspect of such a program.

In some communities, parking management programs have been implemented to reduce automobile traffic and alleviate its negative impacts. In other communities, the strategies are intended to encourage nonwork travel to central business districts as a means of promoting economic growth.

Merchants are often reluctant to consider any changes in municipal parking supplies that might reduce their competitive position with retailers who offer free customer parking. Employers and employees also resist changes because parking is seen as part of an overall benefits package. However, there is a major difference between all-day parking by employees and short-term parking of less than four hours duration for retail business. It is normally easier to deal with parking supply restrictions for employees whose cars sit in the same place for eight hours or more.

Several practical considerations have influenced officials in some cities to call for the development of policy coordination mechanisms that could enhance the effectiveness of parking, transit, and ridesharing policies. These considerations are:[2]

- o A growth rate in auto ownership of 2.5 times the population growth rates during the past 20 years.
- o The increasingly prohibitive expense of structured parking. Construction costs have reached $20,000 a space in downtown Seattle for underground parking. This figure is higher when maintenance costs are added.
- o Proposed cuts in federal funding for transit.
- o Limited urban freeway construction.

Cities may incur the following benefits from limiting parking spaces:

- o More efficient use of space - Parking takes up space that could be used for housing, employment and tax revenue generation.
- o Greater equity - Where there is a charge for parking, the user pays a portion of the cost of providing the parking, just as the transit user has to pay for part of the transit cost.
- o Reduced traffic and roadway maintenance costs - More parking generates more traffic, which requires more road space. This, in turn, increases the cost of maintaining and providing roads.
- o Aesthetic gains from less asphalt and more opportunities for open space and landscaping.

The private sector can also benefit from reducing parking in exchange for providing transit and ridesharing incentives or pedestrian amenities. Cost savings per parking space eliminated can range from $1,000 to more than $15,000, depending on land costs and type of parking facility.

Table 6 indicates typical viewpoints of various groups with an interest in parking.

B. Factors Affecting Parking Demand

The primary factors believed to affect parking demand are:[3]

- o General land use and type of operation
- o Development setting (e.g., density of surrounding development)
- o Temporal effects (e.g., hour of day, season of year)
- o Price of parking
- o Availability of parking
- o Transit services
- o Ridesharing incentives.

A key question in determining the amount of parking to provide at a new building site, particularly a large retail development, is whether to design for the highest ultimate demand or for a lesser figure which lowers parking construction costs but accepts an occasional parking overflow. Design for the highest demand is usually viewed as an unwise investment of resources, and a conscious decision is made to live with a problem for those few days when there is unusually high demand.[4]

TABLE 6. REPRESENTATIVE VIEWPOINTS OR OBJECTIVES OF VARIOUS GROUPS WITH AN INTEREST IN PARKING[1]

Interest groups involved	Primary relevant objectives
Developers/owners	- minimize parking facility cost - provide access for users (more important for certain types of users, e.g., commercial) - ensure leasability/salability of property
Employers/business establishment operators	- provide environment for attracting adequate work force or customers (access is key to that environment)
Users (employees, shoppers, residents, etc.)	- provide adequate access (minimize travel time, maximize convenience) - minimize transportation cost
Community (usually those adjacent to facility under consideration)	- minimize intrusion by users (traffic or parking on neighborhood streets)
Lenders	- Ensure that facilities built are economically viable (this really means satisfying the objectives of those groups i.e., employers and users)
County agency staff	- promote coordinated and managed land development - enhance access to facilities (mobility) - reduce traffic congestion, air pollution and energy consumption - minimize cost to county and its citizens - should consider the objectives of all above groups and maintain a balance that is in the overall public interest

[1]The objectives are generalized for each group. Specific groups or individuals could have objectives which differ from those listed.

Source: JHK and Associates, Parking Policies Study for Montgomery County, Maryland, November 1982.

Research on variations in parking use by time of day, day of week, and season of the year has provided the following guidelines for office buildings:[5]

- Based on a parking count conducted over seven consecutive weekdays, it is estimated that a one-day count would be expected to lie within ± 5-8 percent of the true seasonally adjusted average with 95 percent confidence.

- Pre-Labor Day counts are about 6 percent lower than post-Labor Day counts.

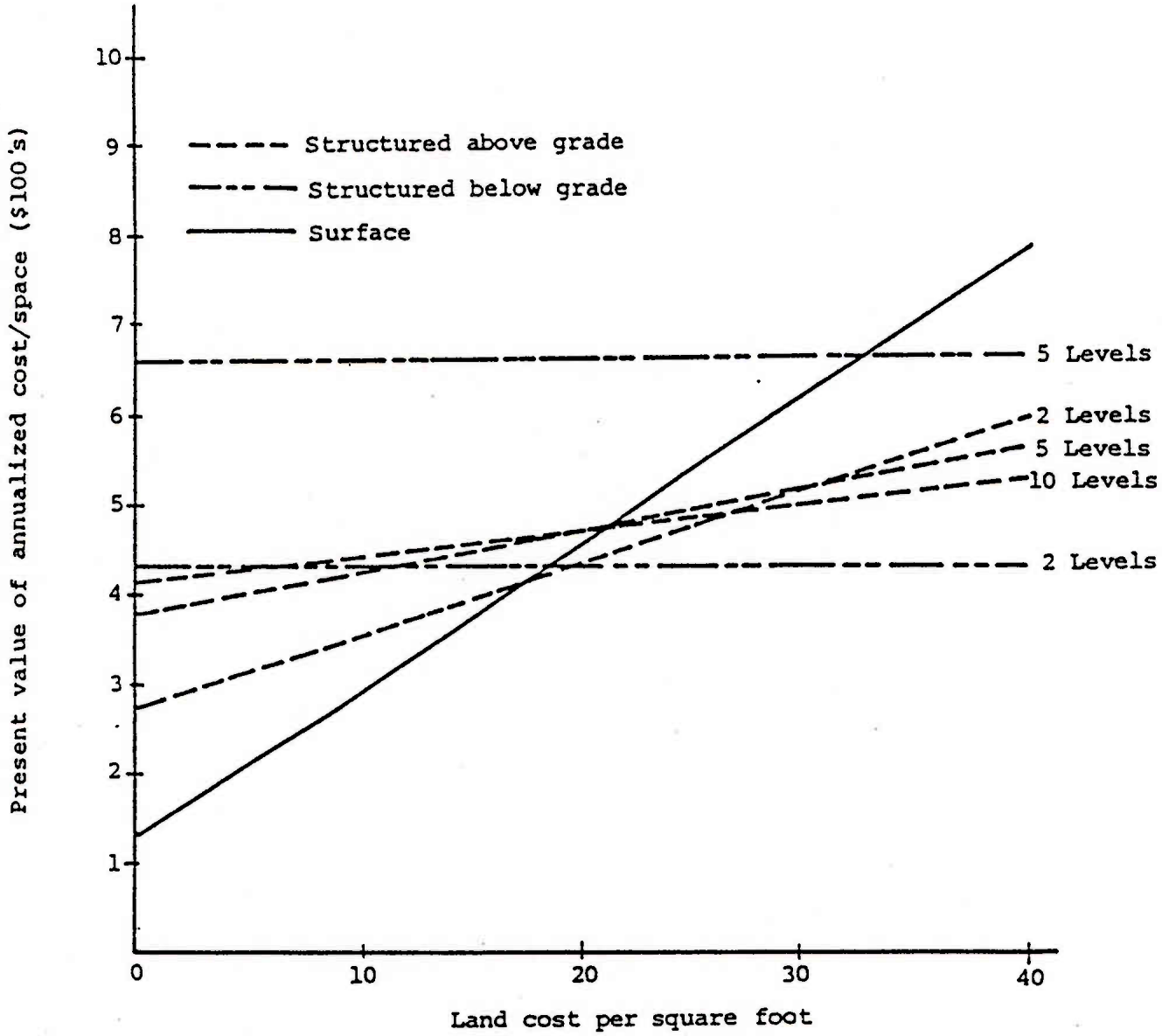
- Parking demand in the summer months is 6-8 percent lower than other seasons, with little difference between demand in fall, winter and spring.

- If January is taken as the peak demand month, the demand at an office building in July would be expected to be about 91 percent of the peak demand.

- Accumulation of parked cars tends to peak at two distinct points during the day: 10 - 11 a.m. and 2-3 p.m.

C. Costs of Parking Construction

An acre of land provides about 135 parking spaces.[6] Assuming industrial land costs $7-10 per square foot and construction costs an additional $4-6 per square foot, the total cost of one surface parking space, the least expensive form of parking, ranges from $3,500 - 5,100 in 1985 dollars.[7] Structural parking typically costs $6,000-$8,000 per space.[8] Costs for underground structures are usually at least double the cost of above-grade parking. (See Figure 9.) Providing 200 spaces in an underground garage could cost well over $2 million.[9] In fact, construction costs for underground parking in CBD office towers may be as high as $20,000 per space.[10] Paved parking areas also require annual maintenance, which typically costs from $150-175 per space.[11]



Note: Construction costs based on ref. Assumes 40 year life, $100 annual maintenance /space for structures, 15 year life, $50 annual maintenance/space for lot; parking spaces =300 s.f.

This chart indicates that the annualized cost per space of surface parking rises steeply as land costs rise. The annualized cost per space for below-grade parking is high because of the additional excavation work involved. The same is true for structured above-grade parking, but costs for the latter are somewhat more sensitive to land costs.

Source: JHK & Associates, Parking Policies Study for Montgomery County, Maryland, November 1982.

FIGURE 9
Estimated Annualized Costs per Parking Space

Land costs are an important factor in the overall cost of parking and in determining the most cost-efficient type of parking. Developers constructing surface parking for a commercial project in a suburban area might not be as interested in getting their parking requirements reduced as developers of an office tower in a CBD location, where land costs are generally much higher.

The possibility of saving money on parking construction might lead a developer to commit to transportation management actions in exchange for lower parking requirements. If the zoning requirement in a large metropolitan area CBD is one space per 1,000 square feet of development, a major office development with 300,000 square feet would incur parking construction costs of approximately $4-5 million. Reduction of just ten spaces in a two-level underground parking structure could justify an annual expenditure of up to $4,000 in a program to promote ridesharing.[12]* Research has shown that operating an organized ridesharing program can reduce employee parking demand by an average of 22 percent.[13]

II. PARKING MANAGEMENT STRATEGIES

Parking management strategies can be classified into the following categories:

- On-street parking supply
- Off-street parking supply
- Pricing
- Fringe parking
- Enforcement and adjudication

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*As an example of what $4,000 could buy in terms of ridesharing services, Metro has calculated the cost of a developer-sponsored vanpool program, based on one 12-passenger van operated over a period of 50 years. In 1986 costs, the annual subsidy per rider would be $120 at a $10/seat/month subsidy level, and the initial investment would be $2,784. This cost does not include purchase or replacement of vehicles.

A study of parking management approaches used in 20 communities throughout the country (shown in Figure 10) indicated that the jurisdictions with the most ambitious programs are Baltimore, Boston, Portland, San Francisco, Seattle, Washington, D.C., and Montgomery County, Md.[14] Each of these jurisdictions has implemented a range of actions that generally covers all six categories. These parking management programs are still working well several years after initial implementation and are having the intended effect on traffic congestion and/or reduction of long-term parking.

A. On-Street Parking Supply

1. Residential Parking-Permit Programs

RPPP's are one of the most widespread forms of on-street parking supply restrictions. They are typically implemented to control the excess parking demand created by persons who live outside a neighborhood but park their vehicles there in order to shop, work, or attend school nearby. RPPP's were determined to be constitutional in a 1977 U.S. Supreme Court decision.[15]

In most cities the ordinances created to establish RPPP's contain usage criteria that must be met by a neighborhood or district if it is to be eligible for a RPPP. The criteria usually require that a traffic survey conducted during peak parking periods reveal 75 percent overall use of available parking space and at least 15 percent nonresident use. Restrictions on nonresident parking range from complete prohibition to limited parking privileges for a duration of two or three hours. A limitation of RPPP's is the increased level of enforcement required.

2. Preferential Parking for HOVs

Preferential parking for HOVs refers to the practice of signing spaces closest to the building entrance for use by carpools and vanpools. It also refers to subsidizing parking rates for HOVs. Off-street preferential parking programs normally involve setting aside a certain number of

EXHIBIT 4

SELECTED PARKING MANAGEMENT TACTICS IN USE BY OR PROPOSED FOR SELECTED JURISDICTIONS

Parking Management Tactics	Jurisdiction																			
	Alexandria, Va.	Arlington, Va.	Baltimore	Boston	Cambridge, Ma.	Chicago	Eugene, Ore.	Hartford, Conn.	Honolulu	Los Angeles	Madison	Milwaukee	Montgomery County, Md.	Palo Alto, Calif.	Portland, Ore.	St. Paul, Minn.	San Francisco	Seattle	Vancouver, B.C.	Washington, D.C.
On-Street Supply																				
Residential Parking Permit Program (RPPP)	●	●	●	●	●		●					●	●	○			●		●	●
Carpool/Vanpool Preferential Parking															●			●		
Institutional TSM Plans																	●	●		
Off-Street Supply in Activity Centers																				
Expand or Restrict Supply in CBD and Activity Centers																				
Zoning Requirements																				
—Maximum and No Minimum Parking Requirements															●		●	●		
—Joint Use										○			●	●	●					
Constrain Normal Growth in Supply																				
—Maximum Ceiling (i.e., Freeze) on CBD Supply				●											●					
—Reduced Minimum Parking Requirements Through HOV and Transit Incentives		●				●				○				●						
—Restrict Principal Use Parking Facilities						●											●	●		
Construct New Municipally-Owned Parking																				
—CBD			●									●		●						
—Neighborhood Shopping Districts										●		●					●			
Carpool/Vanpool Preferential Parking	●		●					●		○		●					●	●		
Fringe and Corridor Parking																				
Fringe Lots			●													○	●	●		
Park and Ride Lots			●					●							●			●		●
Carpool/Vanpool Lots																				

Key:
● - Implemented
○ - Planned

Source: U.S. DOT, Study of Parking Management Tactics: Volume 1, 1980.

FIGURE 10
Parking Management Tactics in Use by or Proposed for 20 Selected Jurisdictions

EXHIBIT 4 (Continued)

Parking Management Tactics	Jurisdiction																				
	Alexandria, Va.	Arlington, Va.	Baltimore	Boston	Cambridge, Ma.	Chicago	Eugene, Ore.	Hartford, Conn.	Honolulu	Los Angeles	Madison	Milwaukee	Montgomery County, Md.	Palo Alto, Calif.	Portland, Ore.	St. Paul, Minn.	San Francisco	Seattle	Vancouver, B.C.	Washington, D.C.
Pricing																				
Increase Parking Rates									●	○≠			●							
Differential Pricing Programs																				
—Rates Favor Short-Term Parker									●						●	●	●			
—Geographical Rate Differentials													●							
—Carpools/Vanpools													●		●		●	●		
Free Downtown Parking							●									●				
Parking Tax																	●			●
Surcharge on Parkers Arriving During "Prime Time" (i.e., 6:30 - 9:30 am)											○									
Enforcement and Adjudication																				
• Aggressive Ticketing				●	●		●					●			●		●			●
• Booting				●																●
• Towing				●											●					●
• Administrative Adjudication																				●
• HOV Enforcement			●										●		●			●		
Marketing																				
Monthly Parking Convenience Stickers							●						●							
Advertising (Media Ads, Brochures, Maps)								●					●		●					

≠Increase Rates For City Employees

Key:

● - Implemented

○ - Planned

FIGURE 10 *(continued)*

spaces in a surface parking lot or garage for carpools. Often, these spaces are also discounted by the developer or employer.

On-street preferential parking programs for carpools or vanpools allow participants to park downtown all day at specific metered locations for small monthly fees by displaying a permit. Carpoolers are exempted from hourly parking limits and fees of meters.

Portland, Oregon and Seattle, Washington have the best-known on-street preferential parking programs for carpools.[16] In both programs carpools are defined as groups of three or more people. An evaluation of the Portland program indicated that two-thirds of the people subscribing to the program were already carpooling or previously used transit.[17] Cost savings was the primary reason for becoming involved in the program.

B. Off-Street Parking Supply in Activity Centers

This parking management approach involves use of development controls to restrict the growth of CBD parking supply by adopting a "no-minimum" or "low minimum" parking requirement, along with a low maximum to discourage increased parking construction. In some cities, joint use of parking facilities is also allowed.

Other cities permit developers to reduce the amount of required parking if certain transit-related conditions are met (such as locating near a transit facility) or if a developer-funded transit/ridesharing incentive program is implemented.

The most comprehensive applications of restrictions in off-street parking supply have occurred in Chicago, Portland, San Francisco, and Seattle.

1. Mandatory Ceilings

Research conducted on local parking policies for Montgomery County, Maryland warns that too restrictive a cap on parking may divert development to other locations which are less desirable from both a land use and transportation perspective. The study notes that planners should be cautious about such programs (setting maximums and low minimums) in low cost suburban areas since an undersupply of parking will not usually result in diversion of trips to alternate modes, but in the overflow of parking onto nearby streets.[18]

Strict limitations on parking in the absence of comprehensive, targeted transit/ridesharing services are seen as best suited for densely developed locations where existing alternate modes are readily available. A delicate balance exists in the desire of an employer to remain at a location and the pressure placed on his/her employees to shift their mode of travel.[19] Recent experience on mode shifts induced by restrictive parking supply strategies (in this case a residential parking permit program) was obtained in Old Town, Alexandria, Virginia. About

17 percent of the commuters affected by the parking permit program reported switching to carpools or buses.[20]

Discussions with developers active in Montgomery County, Maryland indicated little or no need for maximum parking requirements.[21] These developers felt that the cost of land and parking construction are already an effective limitation on parking.

2. Flexible Parking Requirements

Flexible parking requirements relax the amount of off-street parking called for in local zoning codes in return for developer support of public parking, mass transit, or ridesharing programs. Whether the introduction of flexible parking requirements is appropriate in a given jurisdiction depends upon both that city's or county's overall transportation and development objectives, and the existing traffic conditions, transit service, and parking supply.[22] As a general rule, developers will enter into agreements that reduce the parking requirements if the actions called for in the agreements are easy to implement and less expensive than providing the parking.[23]

For many years Chicago has granted a 10 percent reduction in the amount of required parking for buildings that have a direct connection with an underground transit station. A 15 percent reduction is granted for providing underground pedestrian circulation. More common are reductions for simply connecting to an underground pedestrian facility or for being close to a subway or the overhead "L" rail system.[24]

In September 1981, the city of Sacramento, California enacted provisions in its zoning ordinance whereby the minimum is reduced by 5 percent for provision of bicycle facilities, 15 percent for marked carpool/vanpool spaces, and 60 percent for a program to purchase transit passes for use by occupants of the new offices.[25] There are no other means available to obtain parking reductions. Since the ordinance was passed, there have been six applications for development or conversions in the eligible zone, three of which are requesting parking reductions based on ridesharing.

In downtown Seattle the long-term parking requirement for new developments for all uses except lodging may be reduced by providing additional subsidized carpool spaces, vanpools, or subsidized transit passes. One vanpool may be substituted for six parking spaces, not to exceed a 10 percent reduction. Each carpool space in excess of those required may be substituted for 1.9 parking spaces, with the provision that no more than 50 percent of the long-term parking spaces provided should be set aside or discounted for carpools. A 15 percent reduction may be achieved by providing free transit passes to all employees in the building for at least five years.

While most banks and lending institutions still require some on-site parking as a condition for financing the development, many developers indicate they would prefer to build only as much parking as necessary to attract building tenants. The return in investment from leasing floor area as office space far exceeds the return on investment from parking operations. Parking produces less revenue and incurs daily operating costs in addition to building heating, maintenance, etc.

Many North American cities have successfully limited CBD parking by lowering or eliminating the minimum parking requirements in their zoning code. Among these cities are Chicago, Denver, Edmonton, Portland, Oregon, San Francisco, St. Paul, Seattle, Toronto, Vancouver and Calgary. Table 7 indicates the CBD parking policies developed in each of these cities. Most of these cities have found that restrictions on CBD parking supply have not been a deterrent to development.[26]

One way a jurisdiction can grant parking reductions without being subject to spillover parking problems is to require that a certain area of the development site be set aside and held in reserve in case additional parking is determined to be needed in the future. In Dallas, parking relaxations granted by variance are allowed only with the required

TABLE 7
CBD PARKING POLICIES IN SELECTED CITIES

	Maximum	Minimum	
Denver		No parking required in CBD except in urban renewal area.	o CBD office space is expected to reach 44 million sq. ft. by 1985. o Of the 60,000 parking spaces in greater CBD area, 24,000 spaces are in fringe lots. o Recent CBD construction has shown that it is not necessary to have parking in or next to buildings to encourage development.
Edmonton		1 space/1,000 gsf in bldg. or within 400 ft of entrance. 1 space/2,000 gsf if building has direct access to a pedestrian way 1 space/25,000 gsf if direct access to LRT	o Overall CBD parking averages 1 space/2.68 employees. o Number of employees in CBD estimated to be 80,000 in 1986. o City has maintained good rapport with the developers.
Portland	1 space/1,000 gsf - 1 space/1,429 gsf, depending on building's proximity to transit		o City directing high density development to its main transit corridor and freezing the number of allowable downtown parking spaces at the 1973 level of 38,870 (includes on and off-street). o The City believes downtown development has not been deterred by these restrictions.
San Francisco	1 space/4,285 sq. ft. of office space		o Maximum allowable parking bylaw adopted in 1968 for core area to address air quality problems.

Source: Barber, Ellis, Bolger & Brown, New Directions in Central Business District Parking Policies, January 1982.

	Maximum	Minimum	
St. Paul	No maximum in CBD	No minimum in CBD	o The City uses pricing, a fringe parking shuttle bus, and skywalk system to create incentives and disincentives. Over half of CBD parking is for short-term use, fringe parking for long-term parkers. o Developers initially opposed policies, but buildings have been successfully leased (93% occupancy rate).
Toronto	1 space/1,453 nsf	1 space/1,668 nsf	o 1 space per 5.2 employees average in CBD.
Vancouver	1 space/1,000 gsf		o 1 space per 3 employees average in CBD.
Seattle	1 space/1,000 gsf unless special approval given	.67 spaces/1,000 gsf of office +.1 for short-term parking	o City requires 30-40% of the allowable parking to be reserved for carpools and vanpools in CBD office buildings.
	No maximum outside downtown	1 space/1,000 gsf outside downtown area	o Principal use parking garages and lots not allowed in downtown core, only allowed in CBD periphery if no adverse effect on traffic flow or street capacity. o 1 space/2,500 gsf actually being provided in CBD. o Although developers would rather not have any restrictions placed on them, they have been generally supportive of an HOV parking program when required to mitigate the traffic impacts of their developments. o Average of 1 space per 2.64 employees in CBD.

	Maximum	Minimum	
Calgary	On-site parking limited to 20% of total parking required. Rest of requirement fulfilled by cash-in-lieu payments used by city to build peripheral parking structures.		o Peripheral parking structures connected to CBD through climate-controlled pedestrian walkways. o Cash-in-lieu program originally voluntary. Became mandatory. o Developers complained because construction of municipal parking structures lagged behind cash contributions. Developers did not receive any guarantees on the use of spaces when built (e.g., spaces not dedicated to a particular building or its tenants). No benefits to buildings that have excessive walking distances to the parking structure.